UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
Camp Lejeune, North Carolina 28542-0041

LVSM 7302

STUDENT OUTLINE

MAINTAIN THE MK17 HYDRAULICS SYSTEM

LEARNING OBJECTIVES

1. Terminal Learning Objective: Given an LVS, reference, tools, and equipment, perform second echelon maintenance on LVS auxiliary hydraulic system, per the reference. (3521.13.22)

2. Enabling Learning Objectives:

(1) Given an MK48/17, TM 2320-20/12A, inspect the MK17 auxiliary hydraulic system for serviceability, per the reference, (3521.13.22a)

(2) Given TM 2320-20/12A and partial statements pertaining to the MK17 auxiliary hydraulic system, complete the partial statements to describe the procedures used to diagnose a malfunctioning MK17 auxiliary hydraulic system, per the reference.
(3521.13.22b)

(3) Given an MK48/17, TM 2320-20/12A, tools, and equipment, test the MK17 auxiliary hydraulic system, per the reference. (3521.13.22c)

(4) Given an MK48/17, TM 2320-20/12A, tools, and equipment, repair the MKK17 auxiliary hydraulic system, per the reference. (3521.13.22d)

OUTLINE

1. IDENTIFICATION, LOCATION, AND FUNCTION OF COMPONENTS AND PRINCIPLES OF OPERATION OF THE MK17 AUXILIARY HYDRAULICS SYSTEM.

a. General

(1) The MK17 auxiliary hydraulics system consists of only the material handling crane.

(2) The crane hydraulic system is supplied with oil from the MK48. The selector valve on the MK48 directs hydraulic oil from the MK48 front power unit to the trailer units. The selector valve also incorporates the main relief valve for the trailer units. If pressures during crane operation reach 3,250 psi, the main relief valve will open and direct the oil back to the hydraulic reservoir.

(3) Solenoid dump valve. Oil from the selector valve is directed to the solenoid dump valve. When the solenoid dump valve is activated, hydraulic oil is directed through the main control valves.

(a) The solenoid dump valve, located at the rear of the main control panel, is an electrically operated valve that directs oil through the main control valves.

(b) The manual/remote switch activates a solenoid incorporated in the valve which shifts a spool that directs the oil through the main control valves.

(c) During remote operation, the deadman switch on the remote control unit activates the solenoid. If the solenoid dump valve is not activated, hydraulic oil will flow back to the reservoir.

(4) Electrical failure valve. The electrical failure valve serves the same purpose as the solenoid dump valve. It directs the oil through the main control valves. During an electrical failure, if the solenoid dump valve is inoperative, the electrical failure valve will allow for manual crane operation. When this valve is pulled down, it will allow the oil to bypass the solenoid dump valve and flow directly to the main control valves. This electrical failure valve manually overrides the electrical portion of the crane. This allows the operator to finish the crane operation until the electrical circuit can be repaired. The electrical failure valve employs a neutral switch that will cut off all current to the remote system when the electrical failure valve is in use.

(5) Main control valves

(a) The main control valves are open-center-closed port valves. Hydraulic oil always passes through the valves and returns to the reservoir unless one or more of the control valves are activated. When a control valve is activated, hydraulic oil is directed to a particular function of the crane.

(b) Depending on the direction that a control valve lever is moved, hydraulic oil is sent to either the piston or rod end of the cylinder pushing the cylinder in the desired direction. The main control valve also

allows hydraulic oil in the opposite end of the cylinder to return to the reservoir. When the control valve lever is moved in the opposite direction, the function of the main control is reversed and the cylinder changes direction.

(c) The oil in the cylinder end that isn't pressurized returns through the main control valve and back to the reservoir. The main control valves, when in the neutral position, also keep hydraulic oil trapped in the cylinders. This allows heavy loads to be suspended without a constant flow of oil to the cylinder.

(d) Some functions have a port relief valve incorporated in the main control valve. The port relief is a screw-in type cartridge that has a preset pressure rating. If a function exceeds the rated pressure, the port relief will open, causing oil to bypass the main control valve and return to the hydraulic reservoir. The following functions are protected by port relief valves:

1 main boom up and down,

2 folding boom up and down,

3 outriggers out, and

4 stabilizers down.

(6) Holding valves

(a) You may be wondering how the crane is able to maintain its position when the port relief opens up and the oil is diverted back to the reservoir. This is achieved by the holding valves that lock the crane into position when the relief valves open.

(b) The main boom, folding boom, and extension boom functions have a holding valve incorporated within each system. These holding valves are one-way check valves that allow oil to flow in one direction but not in the other. That's what happens when the oil is diverted back to the reservoir. The holding valves trap the oil in the cylinders to keep them suspended.

(7) Slewing cylinders

(a) The slewing cylinders are single-acting cylinders that rotate the crane. Single-acting cylinders can only push in one direction. Therefore, two cylinders are needed for crane rotation; one cylinder for clockwise rotation and the other for counterclockwise rotation.

(b) A restrictor fitting is used to slow down the flow of oil into the slewing cylinder. This allows for a smoother and more accurate rotation.

(c) The slewing cylinders are protected at the main control valve with a port relief. At 2750 psi, hydraulic oil will be routed back to the reservoir, relieving the pressure at the slewing cylinders.

(8) Main boom cylinder

(a) The main boom cylinder is a double-acting cylinder that supports and lifts all the boom assemblies. A double-acting cylinder means that hydraulic oil can be directed to either the piston end to extend or the rod end to retract the cylinder. This gives the main boom hydraulic pressure for power lifting or lowering.

(b) Since the main boom carries the weight of the crane and any load it picks up, any movement or motion will send pressure surges through the hydraulic system. An accumulator is incorporated in the main boom hydraulic circuit to absorb these pressure surges. The main boom is also tied in with the capacity alert system. This system will be covered later on in the lesson.

(9) Folding boom cylinder. The folding boom cylinder is a double-acting cylinder. It operates like the main boom with hydraulic power up or down.

(10) Extension cylinders

(a) There are two extension cylinders used to extend and retract the extension booms. Both extension cylinders are double-acting cylinders. Each extension boom has one cylinder.

(b) The extension cylinders also have hose breakage valves installed at their inlet and outlet ports. The hose breakage valves are like check valves; if a hose in the extension circuit breaks, the sudden rush of oil leaving the cylinder will close the hose breakage valve. Hydraulic oil is now trapped in the extension cylinder. This will lock the cylinder and prevent a load from crashing to the ground.

(11) Outrigger cylinders

(a) The outrigger cylinders are used to extend or retract the outrigger beams. Both outrigger cylinders (left and right) are double-acting cylinders. A restrictor fitting is used to slow down the flow of oil to the

cylinders to provide for a slower and smoother operation of the outrigger cylinders.

(b) The outrigger cylinders have lock valves incorporated in the system. The lock valves lock the hydraulic oil in the cylinders to prevent unwanted movement after they have been deployed.

(12) Stabilizer cylinder

(a) The stabilizer cylinders are used to balance and support the vehicle during crane operation. Both stabilizer cylinders, left and right, are double-acting cylinders.

(b) Stabilizer leg and outrigger lock valves are incorporated in the system to lock the hydraulic oil in the stabilizer cylinders after they have been deployed. This prevents unwanted movement.

1 The lock valves are simple open and close valves that are manually operated. In the open or unlocked position, hydraulic oil can flow through the valve. In the closed or locked position, hydraulic oil is completely blocked.

2 The lock valves serve two purposes. They separate the outrigger hydraulic circuit from the stabilizer leg circuit and they lock the hydraulic oil in the cylinders after they have been deployed.

b. Crane's Capacity Alert System

(1) The capacity alert system protects the crane from damage caused by overloaded conditions. Once the crane reaches its maximum load, the capacity alert system will stop all functions that increase the crane's reach. The reach is the distance from the center of the crane to the load. Since increasing the crane's reach results in added stress on the crane, the capacity alert system only allows functions that decrease the crane's reach. This allows the operator to continue working without damaging the crane.

(2) The capacity alert system consists of the following components:

(a) Capacity alert sensor valve,

(b) Capacity alert dump valve,

(c) Junction box,

(d) Proximity switch,

(e) Accumulator, and

(f) Needle valve.

1 Capacity alert sensor valve. The capacity alert sensor valve is located at the base of the crane. The valve monitors the hydraulic pressure in the main boom lift cylinder. If the pressure exceeds the specified limits, the capacity alert sensor opens a route allowing the hydraulic oil to return to the hydraulic reservoir. Since hydraulic oil follows the path of least resistance, the oil will go to the reservoir instead of trying to lift a load. This is why the crane will stop operating.

2 Capacity alert dump valve. The capacity alert dump valve diverts hydraulic oil flow away from the folding boom's up or down function. A solenoid shifts a spool valve inside the capacity alert dump valve and prevents the folding boom from lifting or lowering, depending on the position of the solenoid operated spool valve. The proximity switch determines the position of the solenoid operated spool valve.

3 Junction box. As you were taught in the electrical system lesson, the junction box is located on the right slewing cylinder and receives its power from the MK48. The junction box is also the center for all of the crane's electrical operations.

4 Proximity switch. The proximity switch is located on the folding boom. It tells the capacity alert dump valve if the folding boom is above or below the horizontal position. If the folding boom is above the horizontal position, the proximity switch signals the solenoid on the capacity alert dump valve and prevents lowering. If the folding boom is below the horizontal position, the proximity switch prevents raising.

5 Accumulator. The accumulator is located in the pilot line between the main lift cylinder and needle valve. The accumulator protects the hydraulic system from damage by absorbing shocks in the crane's capacity alert system.

6 Needle Valve. The needle valve is located in the pilot line between the accumulator and the main boom lift cylinder. The needle valve dampens the pressure to the capacity alert sensor valve and prevents it from activating when it should not.

2. IDENTIFICATION, LOCATION, AND FUNCTION OF THE MK16 HYDRAULIC SYSTEM COMPONENTS

a. MK16 Hydraulic Winch Assembly

(1) The hydraulically driven winch receives its oil supply from the MK48. The MK16's winch is the same as that on the MK15. Only their mounting points and control functions differ.

(2) The MK16 winch is bolted directly to the vehicle's frame and must be shimmed to provide a level mounting surface.

(3) The winch consists of five major parts:

(a) hydraulic motor,

(b) winch brake,

(c) counterbalance valve,

(d) planetary gearing, and

(e) winch drum.

(4) Hydraulic motor

(a) The hydraulic motor is located on the right side of the winch as viewed from the rear.

(b) The hydraulic motor supplies input power to the winch planetary gearing. The motor is a variable displacement, axial piston type.

(5) Winch brake

(a) The winch brake is located on the left side end of the winch as viewed from the rear.

(b) The winch brake is spring applied and hydraulically released, using friction discs to generate the braking force. The brake automatically releases any time hydraulic pressure above 200 psi is present at either of the motor ports.

(c) Should pressure be lost due to some hydraulic system failure, the brake will set immediately and hold the load until power is restored. The winch brake is controlled by the counterbalance valve.

(6) Counterbalance valve

(a) The counterbalance valve is located and mounted at the end of the winch motor.

(b) The counterbalance valve functions as a free-flow check valve when a load is being raised, allowing smooth operation with little power loss.

(c) When the load is lowered, the valve becomes a throttling valve piloted by system pressure. The throttling action meters the hydraulic fluid flowing through the winch motor to provide very fine load positioning control when lowering. This makes sure that the load will hold and not become uncontrolled.

(7) Planetary gearing

(a) The planetary gearing is located between the winch brake and winch drum.

(b) The planetary gearing consists of three planetary carriers and their ring gears. Power from the hydraulic motor is delivered through the input shaft to the primary planetary carrier after the winch brake is released.

(c) Power is then transferred to the secondary planetary gearing carrier, and finally, to the final planetary carrier where power is transferred to the output shaft.

(d) The planetary gear action will automatically vary the output power depending on the amount required.

(8) Winch drum

(a) The winch drum is located between the hydraulic motor and planetary gearing. The winch cabling is anchored to the drum by a clamp.

(b) The output shaft is keyed to the winch drum to allow power from the planetary gearing to run the drum in either direction.

b. Winch Control Components

(1) Side pull relief selector valve. The side pull relief selector valve is the same on both the MK16 and MK15. Only their locations will vary. The side pull relief selector valve has two positions.

(a) Straight pull [OFF] position. In this position, the winch is capable of pulling 60,000 pounds in a straight ahead pull position.

(b) Side pull [ON] position. In the side pull position, the side pull relief selector valve limits the amount of pulling capacity to only

10,000 pounds. This position is used in the event the cable is not pulling a center load, and the difference from the center is 10 degrees on either side. The side pull position will not allow more stress on the cable and winch drum than they are capable of handling.

(2) Winch control valve. The winch control valve controls the operating position of the winch; in or out. Since the configuration is different on the MK15 and MK16, we'll discuss them both.

(a) MK15 winch control valve. The MK15 winch control valve is located on the same main control valve bank which operates the crane. It, of course, has its own separate control lever to operate the winch in or out. It also has the capability to be remotely operated. Remote operation for the winch is located on the remote control unit, along with the crane control switches and A-frame hoist.

(b) MK16 winch control valve. The MK16 winch control valve is slightly different, but operates the same for controlling the winch in or out. It can only be electrically activated by an umbilical remote cable. There are no control levers on the MK16.

3. MK15 AUXILIARY HYDRAULICS SYSTEM

a. The MK15 performs two functions that the MK17 does not; winch and wrecker hoist operation.

b. The MK15 has two additional port reliefs, one for winch out and one for the auxiliary tools.

c. The side pull relief selector valve is on the winch on the MK16 and on the control panel on the MK15.

d. The winch control valve, which we just discussed, is also different.

4. MAINTENANCE RESPONSIBILITIES RELATIVE TO REPLACING COMPONENTS OF THE LVS AUXILIARY HYDRAULICS SYSTEM

a. The organizational automotive mechanic working in a second echelon maintenance activity is responsible for replacing the following components on the MK15 and MK17 hydraulic cranes:

(1) Number 1 and 2 extension cylinders.

(2) Outrigger cylinders.

(3) Stabilizer leg cylinders.

(4) Outrigger and stabilizer leg lock valve.

(5) Electrical failure valve.

(6) Proximity switch.

(7) Electrical junction box and internal components.

b. The organizational automotive mechanic, working at the second echelon level, is also responsible for replacing the A-frame cylinder on the MK15 and adjusting the holding valves and proximity switch on the MK15 and MK17.

c. The second echelon organizational automotive mechanic is responsible for replacing the cable assembly on the MK15 and MK16 winch. Additionally, the organizational mechanic is responsible for repairing the umbilical remote control assembly on the MK16.

d. The organizational automotive mechanic, MOS 3521, at the third echelon level, is responsible for performing the previously mentioned tasks and replacing the remaining hydraulic components.

e. The third echelon mechanic is also responsible for repairing the slewing cylinders, charging the accumulator, and adjusting and testing the crane components prior to load testing.

5. MAINTENANCE PROCEDURES RELATIVE TO TESTING AND ADJUSTING THE AUXILIARY HYDRAULICS SYSTEM COMPONENTS

a. The organizational automotive mechanic working in second echelon must ensure that various components on the MK15 or MK17 are tested, and if required, adjusted prior to load testing:

(1) The components in the auxiliary hydraulics system that must be tested and, if required, adjusted are the:

(a) Main relief pressure (main control valve bank).

(b) Extension boom double holding valve.

(c) Folding boom holding valve.

(d) Main boom holding valve.

(e) A-frame holding valve (MK15 only).

(f) Outrigger beam (adjustment only).

(2) Testing and adjusting main relief pressure on the MK17. Before any other testing can be performed on the crane of the MK17, the main relief pressure must conform to specifications.

(a) First, connect a 0-5,000 psi pressure gage to the test port at the main control valve bank.

(b) Next, unstow the crane and pull the folding boom lever down to force the pressure relief valve open. The reading on the pressure gage should be 2950-3050 psi.

(c) If the pressure reading is above 3050 psi or below 2950 psi, adjust the relief valve.

1 First, remove and discard the wire seal on the relief valve.

2 Next, loosen the jam nut on the relief valve.

3 Back off the set screw three to four turns.

4 Pull and hold the folding boom lever down.

5 Now, read the pressure gage, and adjust the set screw until the pressure gage reads within 2950-3050 psi.

6 Hold the set screw in position and tighten the jam nut securely.

7 Recheck for correct pressure reading, and adjust if necessary.

8 Install a new wire seal once the correct setting has been obtained.

9 Finally, remove the pressure gage from the test port.

(3) Testing and adjusting the extension boom double-holding valve. The extension boom double-holding valve has two adjustment points for either extending or retracting the extension boom cylinders. Testing and adjustment procedures are as follows:

(a) Unstow the crane and operate it to position the extension boom double-holding valve within adjustment reach; extend the extension boom approximately two feet.

(b) Install a 0-5,000 psi pressure gage at the main control valve bank test port.

(c) Have an assistant slowly pull the extension boom control lever down (retract) while observing the pressure gage needle and extension booms for movement.

(d) When the extension booms begin to move, note the pressure reading; movement should begin at 1000 psi ± 100 psi.

(e) Release the extension boom control lever.

(f) If the pressure is below or above 1000 psi, adjust the holding valve.

1 First, loosen the jam nut on the holding valve by turning it counterclockwise several turns.

2 Next, turn the set screw, IN (clockwise) for BELOW specifications or OUT (counterclockwise) for ABOVE specifications, a quarter of a turn and check the pressure reading by following the steps during testing.

3 Repeat adjustment as necessary to obtain 1,000 psi ± 100 psi.

4 Now, lock the set screw in place with the jam nut once the reading is within specifications.

(g) To test the extend portion of the double-holding valve, the testing and adjustment procedures are the same. The only difference will be to slowly push the extension boom control lever up to extend the extension booms, and that adjustment, if required, will be accomplished at the other end of the holding valve.

(h) After all testing and adjusting has been accomplished, remove the gage from the test port.

(4) Testing and adjusting the folding boom holding valve.

(a) First, unstow the crane to operating position.

(b) Next, install a 0-5,000 psi pressure gage at the main control valve bank test port.

(c) Have an assistant slowly pull the folding boom control lever down to retract the folding boom, while you observe the pressure gage and folding boom for movement.

(d) When the folding boom begins to move, note the pressure reading on the gage. The pressure should be 1,000 psi ± 100 psi.

(e) The folding boom control lever should be released once the movement and pressure reading has been noted.

(f) If pressure is below or above 1000 psi, adjust the holding valve as follows:

1 First, remove and discard the wire seal on the holding valve.

2 Next, loosen the jam nut by turning it counterclockwise several turns.

3 Now, turn the adjusting cap nut; IN (clockwise) for BELOW specifications or OUT (counterclockwise) for ABOVE specifications, a quarter of a turn and check the pressure reading by following the steps during testing.

4 Repeat the adjustment as necessary to obtain 1,000 psi ± 100 psi.

5 Lock the adjusting cap nut in place with the jam nut once the reading is within specifications.

6 Finally, install a new wire seal on the holding valve and remove the pressure gage from the main control valve bank test port.

(5) Testing and adjusting the main boom holding valve. The testing and adjusting procedures are the same as the folding boom holding valve with the exception of the pressure reading. Movement should begin at 2,000 psi ± 100 psi.

(6) Adjusting the outrigger beams. If the outrigger beams bind during operation, it may be necessary to check the adjustment of the outrigger beams. Additionally, the alinement of both outrigger beams is adjusted by leveling the right outrigger beam with its housing as follows:

(a) First, fully extend the right and left outrigger beams.

(b) Next, swing the right and left stabilizer cylinders into position, but don't allow the pads on the stabilizer cylinders to contact the ground.

(c) Clean the top surface of the right outrigger beam housing. Then, place a level on the top surface of the right outrigger beam housing and note the reading of the level.

(d) Once that has been done, do the same level check at the left outrigger beam housing. Make sure you clean the top surface of the outrigger beam.

(e) Under normal conditions, meaning no binding, both readings taken from the outrigger beams should be the same. If they do not read the same, perform the following steps:

1 Make sure the right and left outrigger beams are fully extended.

2 Now, loosen the jam nut and turn the adjusting screw in or out while checking alinement of the outrigger beams as was previously described to you.

3 After the outrigger beams are alined, operate the outrigger beam controls to check for proper operation.

4 If proper alinement has been accomplished, tighten the jam nut securely and stow both stabilizers and both outrigger beams.

5. MAINTENANCE PROCEDURES RELATIVE TO TESTING AND ADJUSTING THE AUXILIARY HYDRAULICS SYSTEM (CONTD)

b. In the event that the vehicle cannot pass the load testing specifications at the load test facility, the vehicle will have to be evacuated to third echelon maintenance for further testing and adjustment.

(1) The components in the auxiliary hydraulics system that must be tested and, if required, adjusted are the:

(a) Accumulator,

(b) Pretension valve,

(c) Capacity alert system, and

(d) Needle adjusting valve.

(2) Testing, charging, bleeding, and securing the accumulator.

(a) Testing the accumulator charge.

1 Protective equipment (goggles and gloves) must always be worn when working with compressed gases. The open end of the charger hose must never be left unattended or unrestrained, a hose whipping action will occur when the gas is turned on.

2 Prior to testing the accumulator, all hydraulic pressure should be relieved, electrical power should be shut off on the MK48, and the crane's control levers stroked in both directions.

3 Now, remove the cap from the accumulator.

4 Next, turn the tee bar handle on the gage head assembly counterclockwise until it stops turning.

5 Connect the chuck on the gage head assembly to the accumulator valve stem, and make sure the connections are secure.

6 Now turn the tee bar handle clockwise to open the accumulator valve stem.

7 Read the pressure gage to find the charge in the accumulator. The pressure reading should be 1,450-1,550 psi.

a If the pressure is below the specifications, the accumulator must be charged.

b If the pressure is above the specifications, the accumulator must be bled.

(b) Charging the accumulator

1 Only nitrogen gas should be used for charging the accumulator. Severe injury or death may occur if any other gases are mixed.

2 First, install the gage assembly on the nitrogen bottle, and tighten it securely.

3 Next, connect one end of the hose to the gage assembly attached to the accumulator bottle and the other end of the hose to the gage

head assembly attached to the accumulator. Tighten the hose fittings securely.

4 Slowly open the valve on the nitrogen bottle. The valve should be closed periodically during charging to settle the gas so an accurate reading can be obtained.

5 Pressurize the accumulator until a reading of 1,450-1,550 psi is obtained on the gage head assembly. Close the valve on the nitrogen bottle when the correct pressure is reached.

6 When the correct pressure is reached, remove the hose from the gage head assembly and the gage assembly, and remove the gage assembly from the nitrogen bottle.

(c) Bleeding the accumulator

1 First, make sure that all hydraulic system pressure has been relieved.

2 Next, slowly open the bleeder valve at the bottom of the gage head assembly.

3 When the reading of the gage reaches 1,450-1,550 psi, close the bleeder valve.

4 Now that the accumulator is properly charged, the accumulator can be secured.

(d) Securing the accumulator

1 First, turn the bar handle on the gage head assembly counterclockwise until it stops.

2 Next, remove the chuck and gage head assembly from the accumulator.

3 Now check the accumulator valve stem for leaks by applying a solution of soap and water on the valve stem.

4 If the accumulator valve stem is leaking, depress the valve core quickly once or twice, using a screwdriver.

5 If the accumulator valve stem is still leaking, the accumulator will have to be replaced.

6 Finally, install the cap over the accumulator valve stem and valve core.

7 The accumulator charge should be tested after one week to ensure that it is still charged to specifications.

(3) Testing and setting the pretension valve.

(a) Testing the pretension valve.

1 First, unstow the crane and place a container under the vehicle, in the area of the pretension valve.

2 Install a vacuum pump and create a vacuum on the hydraulic system as you should always do before loosening any hydraulic hoses or fittings.

3 Next, remove the hose elbow fitting from the pretension valve, and install a tee fitting between the pretension valve and the hose fitting. Make sure the connections are tightened securely.

4 Install a 0-5000 psi pressure gage onto the tee fitting.

5 Now, lower the main boom and note the pressure reading on the gage.

6 With the reading recorded, remover the gage and tee fitting and install the hose elbow fitting on the pretension valve.

7 Next, on the opposite side of the pretension valve, loosen the tube fitting on the pretension valve.

8 With the tube fitting loosened, loosen the two capscrews securing the brackets and pretension valve to the side of the main boom holding valve, and slide the pretension valve out of the brackets.

9 Now, install a tee fitting between the pretension valve and tube fitting. Tighten the fitting and tee securely.

10 Install a 0-5000 psi pressure gage onto the tee fitting.

11 Lower the main boom and note the pressure reading on the gage.

12 Now compare the difference in the two gage readings. The difference in the two gage readings should be no more than 1025 $\pm$ 25 psi.

An adjustment is required if the difference in the reading is not within the specifications.

13 Remove the tee fitting and gage between the pretension valve and tube fitting.

(b) Adjustment of the pretension valve.

1 First, loosen the set screw inside the pretension valve and turn the adjustment plate clockwise to increase pressure or counterclockwise to decrease pressure.

2 Next, install the fitting into the pretension valve and install the tee fitting and gage between the pretension valve and tube fitting.

3 Repeat the previous described test until the difference in the gage readings is between 1,000-1,050 psi.

4 When the correct reading is obtained, remove the tee fitting and pressure gage, install the tube fitting on the pretension valve, and secure the pretension valve to the main boom holding valve.

5 If the main boom will not lower or lowers slowly after adjusting the pretension valve, it will be necessary to adjust the holding valve.

(4) Setting and testing the capacity alert system.

(a) Setting the capacity alert system.

1 First, unstow the crane and attach a 9,000 pound load to the crane.

2 Next, position the main boom at 45 degrees.

3 Now, position the folding boom in a level horizontal position.

4 Extend the boom extensions until they stop.

5 The capacity alert system is set at 16 feet, 6 inches to provide a working dimension of 15 feet.

6 Using the grease fitting at the base of the turret as the center of rotation, measure the distance from the center of rotation on the turret to the center line of the rated load.

7 The distance from the center of rotation to center line of the rated load should be 16 feet, 6 inches. If the measurement is not within specifications, the capacity alert sensor valve must be adjusted.

(b) Adjustment of the capacity alert system

1 First, remove and discard the crimp seal from the capacity alert sensor valve.

2 Next, loosen the sensor valve jam nut and turn the adjusting screw a quarter turn, IN (clockwise) to increase distance or OUT (counterclockwise) to decrease distance.

3 Now retract and extend the boom extensions and recheck the distance from the center of rotation to the center line of the load.

4 If the measurement is still not within specifications, turn the sensor valve adjustment screw a quarter of a turn at a time until the distance from the center of rotation to the centerline of the load is 16 feet, 6 inches.

5 When the testing and adjustment is complete, tighten the jam nut on the sensor valve, install a new crimp seal, remove the rated load, and stow the crane.

(5) Testing and setting the needle adjusting valve.

(a) Testing the needle adjusting valve.

1 First, unstow the crane and attach a 9,000 pound load to the crane.

2 With the load attached, position the main boom at a 45 degree angle.

3 Next, position the folding boom in a level horizontal position and extend the boom extensions to 15 feet.

4 Now raise the main boom all the way up and then lower the main boom; watch for a bouncing or ratcheting motion.

5 If the main boom will not lower, or if it bounces or ratchets, the needle adjusting valve requires adjustment.

(b) Setting the needle adjusting valve.

1 First, loosen and discard the crimp seal from the needle adjusting valve, and loosen the jam nut on the adjusting needle.

2 If the main boom will not lower, turn the adjusting needle OUT (counterclockwise) one quarter of a turn. This procedure should be repeated until the main boom lowers smoothly.

3 If the main boom bounces or ratchets as it is lowered, turn the adjusting needle IN (clockwise) one half turn. This procedure should be repeated until the main boom lowers smoothly.

4 Now that the needle valve is properly set and the main boom lowers slowly with no bouncing or ratcheting motion, tighten the jam nut and install a new crimp seal.

6. DIAGNOSING A MALFUNCTIONING LVS AUXILIARY HYDRAULICS SYSTEM

a. Diagnosing a Malfunctioning MK17 Auxiliary Hydraulics System

(1) Crane is inoperative and all functions are slow.

(a) First, install a flowmeter in line between line 906 at the articulation joint.

1 Open the pressure control valve on the flowmeter fully by turning the control knob counterclockwise to DECREASE.

2 Next, start the engine and allow it to run at an idle.

3 Position the selector valve in the auxiliary hydraulics position.

4 Now, slowly close the pressure control valve on the flowmeter by turning the control knob clockwise to INCREASE.

5 Stop turning the knob when a working pressure of 3,250 psi is reached and check for 10-12 gpm.

a If the gpm flow is not within specifications at system pressure, check system pressure at test port 6.

b If the gpm flow is within specifications at system pressure, the front power unit's hydraulic system is functioning properly.

(b) Next, install a flowmeter in line between line 907 at the articulation joint.

1 First, open the pressure control valve fully to DECREASE.

2 Next, start the engine and allow it to run at an idle.

3 Position the selector valve in the auxiliary hydraulics position.

4 Now, check for 10-12 gpm.

a If the gpm flow is not within specifications, check for restrictions in the return lines, return manifold, manual control valves, or hydraulic filter.

b If the gpm flow is within specifications, check the crane's electrical system as was taught in a previous lesson.

(2) Outrigger beam will not extend or extends slowly.

(a) Prior to performing this or any other tests on the auxiliary hydraulics system, make sure there are no restrictions in pressure or return lines and the selector valve is in the auxiliary hydraulics position.

(b) First, remove the hydraulic line that goes to the piston end of the extension cylinder.

(c) Next, install a flowmeter in line between the extension cylinder and the line that was disconnected.

(d) Open the pressure control valve on the flowmeter to DECREASE.

(e) Now, start the engine and allow it to run at an idle.

(f) Have an assistant operate the outrigger beam control lever to fully extend the outrigger beam.

(g) Now, close the pressure control valve to increase pressure to 1500-1650 psi working pressure.

1 If the pressure is not within specifications, replace the outrigger/stabilizer control valve at the main control valve bank.

2 If the pressure is within specifications, repair or replace the extension cylinder.

(3) The stabilizer leg will not extend or retract or extends or retracts slowly.

(a) First, remove the line from the piston end of the stabilizer leg and install a flowmeter in line between the stabilizer leg piston and the line.

1 Open the pressure control valve on the flowmeter to DECREASE.

2 Start the engine and allow it to run at an idle.

3 Position the selector valve in the auxiliary hydraulics position.

4 Now have an assistant operate the control lever to fully extend the stabilizer leg.

5 Next, slowly close the pressure control valve on the flowmeter to increase pressure to a working pressure of 1550-1650.

a If the pressure is not within specifications, replace the outrigger/stabilizer control valve.

b If the pressure is within specifications, repair or replace the stabilizer cylinder.

(b) Next, remove the line from the rod end of the stabilizer leg cylinder and, install a flowmeter in line between the stabilizer leg cylinder and line.

1 Open the pressure control valve on the flowmeter to DECREASE.

2 Start the engine and allow it to run at an idle.

3 Position the selector valve in the auxiliary hydraulics position.

4 Now have an assistant operate the control lever to fully retract the stabilizer leg.

5 Slowly close the pressure control valve to increase pressure to create a working pressure of 1550-1650 psi.

a If the pressure is not within specifications, replace the outrigger/stabilizer control valve.

b If the pressure is within specifications, repair or replace the stabilizer leg cylinder.

(4) The stabilizer legs will not hold a load.

(a) First, remove the line from the piston side of the stabilizer leg and lockout valve.

(b) Next, install a 0-2000 psi pressure gage in line between the stabilizer leg and lockout valve.

(c) Now have an assistant extend the stabilizer leg and close the lockout valve.

(d) Check the pressure gage and record the reading.

(e) Next, have an assistant operate the control valve to extend the stabilizer leg.

(f) Again, check the gage and record the pressure reading.

1 If a pressure increase is noted, replace the lockout valve.

2 If no pressure increase is noted, replace the stabilizer cylinder.

b. Diagnose a Malfunctioning MK16 Winch Assembly

(1) Winch will not operate in either direction.

(a) First, remove the brake release line from the winch.

(b) Next, install a tee fitting and a 0-2000 psi pressure gage in line between the winch and the brake release line.

(c) Now operate the winch in and out and check for a minimum of 200 psi in both directions.

1 If the pressure readings are within specifications in both directions, replace the winch brake assembly.

2 If the pressure readings are not within specifications in both directions, replace the counterbalance valve.

(2) Winch will not control a load when paying out.

(a) First, remove line 900 from the winch motor and install a flowmeter in line between the winch motor and line 900.

(b) Next, open the pressure control valve fully to DECREASE.

(c) Start the engine and operate the winch IN; record the pressure reading.

(d) Now remove the flowmeter and install line 900; remove line 901 and install a flowmeter in line between the winch motor and line 901.

(e) Open the pressure control valve fully to DECREASE, start the engine, and operate the winch out. Record the pressure reading.

(f) Finally, check for a 200-350 psi increase from the first reading. If a pressure increase is not present, replace the counterbalance valve.

(3) The winch will not pull a maximum load.

(a) Remove the brake release line at the winch and plug the brake release line and its opening on the winch.

(b) Next, remove line 900 from the winch motor and install a flowmeter in line between the winch motor and line 900.

(c) Open the pressure control valve on the flowmeter to DECREASE.

(d) Now, start the engine and operate the winch IN.

(e) Check for a pressure reading of 2800-2875 psi.

(f) Now, connect the brake release line to the winch.

1 If the pressure reading is within specifications, replace the hydraulic winch motor.

2 If the pressure reading is not within specifications, determine system relief pressure.

(g) Remove the plugs from the brake release line and its opening on the winch motor and connect the brake release line to the winch motor.

(h) Open the pressure control valve on the flowmeter to DECREASE.

(i) Start the engine and allow it to idle.

(j) Now, operate the winch IN and slowly close the pressure control valve on the flowmeter to INCREASE.

(k) Determine system relief pressure and record the reading.

1 If the pressure is between 2800-2875 psi, replace the hydraulic motor.

2 If the pressure is not between 2800-2875 psi, replace the winch control valve. (MK15 only)

3 If the pressure is not between 2800-2875 psi, replace the relief valve mounted on the winch control valve. (MK16 only)

(4) The winch will not pull a maximum side load.

(a) Check for correct operating pressure at the winch motor.

1 First, place the winch selector valve in the side pull position.

2 Next, remove the brake release line at the winch motor and plug the brake release line and the opening at the winch motor.

3 Remove line 900 from the winch motor and install a flowmeter in line between the winch motor and line 900.

4 Open the pressure control valve on the flowmeter fully to DECREASE.

5 Now, start the engine and operate the winch in. Check for 1350-1450 psi.

a If the pressure is within specifications, replace the hydraulic winch motor.

b If the pressure is not within specifications, determine system relief pressure.

(b) Determine system relief pressure.

1 First, remove the plugs from the brake release line and the opening in the winch motor and, connect the brake release line to the winch motor.

2 Next, open the pressure control valve on the flowmeter fully to DECREASE.

3 With the control valve on the flowmeter opened, start the engine and increase to maximum speed.

4 Operate the winch IN and slowly close the pressure control valve on the flowmeter to INCREASE.

5 Now determine system relief pressure and record the reading.

a If the pressure is between 1350-1450 psi, replace the winch motor.

b If the pressure is not between 1350-1450 psi, replace the winch selector valve.

REFERENCES:

TM 2320-20/12A
TM 2320-34/13A